What is claimed is:

1.   A pattern measuring apparatus comprising:

a storage device which stores a plurality of pattern images of a pattern to be measured and edge reference data which is used as reference to detect the edge of the pattern within the pattern images and is configured of a plurality of pixels that are disposed so as to have an intensity gradient, the pattern images being obtained by an external imaging device at different focal distances;

a calculator which scans the pattern image with said edge reference data, detects edge points of the pattern, and also calculates a characteristic quantity   that expresses a correlation between said edge reference data and the detected edge points of the pattern;

a determinator which determines an in-focus state that expresses the degree to which the focal position at which each pattern image is obtained conforms to a desired pattern edge, based on the calculated characteristic quantity;

an image selector which selects the pattern image that conforms to measurement of the pattern from a plurality of the pattern images, in accordance with the determination result of said in-focus state determinator; and

a measurer which processes the selected pattern image to measure the pattern.

2.   The pattern measuring apparatus according to claim 1,

wherein said external imaging device includes an optical system which is capable of adjusting focal position thereof within a range defined by an integer multiple of a predetermined step width from a predetermined initial value; and

the plurality of the pattern images are pattern images that have been obtained by imaging at each of focal positions calculated by adding integral multiples of the step width to said initial value.

3.   The pattern measuring apparatus according to claim 1,

      wherein said image selector selects a plurality of
pattern images in accordance with the determination results
of said in-focus state determinator;

      said pattern measuring apparatus further comprises an
image processor which performs alignment processing among
said selected plurality of pattern images and superimposes
in a single coordinate system the edge points of the
pattern within the pattern images; and

      said measurer measures the pattern on the basis of
position coordinates of pattern edge points that have been
superposed in said single coordinate system.

4.   The pattern measuring apparatus according to claim 1,

      wherein said image selector selects a plurality of
pattern images in accordance with the determination results
of said in-focus state determinator;

      said pattern measuring apparatus further comprises an
image processor which performs alignment processing between
said selected plurality of pattern images and performs
image processing to combine the selected pattern images;
and

      said measurer measures the pattern on the basis of the
combined pattern images.

5.   The pattern measuring apparatus according to claim 1,

      wherein only edge points of the pattern which have been
detected from previously processed pattern images and which
are within a predetermined range are scanned with said edge
reference data.

6.   The pattern measuring apparatus according to claim 1,

      wherein the pattern has a plurality of edge lines;

      said calculator classifies said edge points that have
been detected into edge point groups for each of said edge

lines, and calculates a characteristic quantity for each of said edge point groups that have been classified; and

said determinator determines the in-focus state of the pattern image for each of said edge point groups that have been classified.

7. A pattern measuring apparatus which is connectable to an external imaging device and which inspects a pattern to be measured on the basis of a pattern image supplied from the external imaging device, the external imaging device capturing an image of the pattern to be measured with an optical system, a focal position of the optical system being adjustable with respect to the pattern by an integer multiple of a predetermined step width from a predetermined initial value, said pattern measuring apparatus comprising:

a storage device which stores edge reference data which is used as reference to detect the edge of the pattern within pattern images and which is configured of a plurality of pixels that are disposed so as to have an intensity gradient;

a characteristic quantity calculator which scans each pattern image with said edge reference data, detects edge points of the pattern to be measured, and also calculates a characteristic quantity that expresses a correlation between the detected pattern and said edge reference data;

a determinator which determines an in-focus state that expresses the degree to which the focal position at which each pattern image is obtained conforms to a desired pattern edge, based on said characteristic quantity that has been calculated;

a measurer which operates to process the pattern image to measure the pattern if said determinator has determined that the focal position at the time of capture of the pattern image conforms to said desired pattern edge; and

a focal-position controller which generates and outputs control signals to change the focal position of the

optical system of the external imaging device if said determinator has determined that the focal position at the time of capture of the pattern image does not conform to said desired pattern edge.

8. The pattern measurement apparatus according to claim 7, wherein only a predetermined range of edge points of the pattern which have been detected from previously processed pattern images are scanned with said edge reference data.

9. The pattern measurement apparatus according to claim 7, wherein the pattern to be measured has a plurality of edge lines;

said characteristic quantity calculator classifies said edge points that have been detected into edge point groups for each edge line to calculate said characteristic quantity for each of said edge point groups that have been classified; and

said determinator determines the in-focus state of the pattern images for each of said edge point groups that have been classified.

10. The pattern measuring apparatus according to claim 7, wherein said characteristic quantity is calculated by using a plurality of sets of said edge reference data.

11. A method of measuring a pattern to be measured from a plurality of pattern images obtained by capturing the pattern by an imaging device at different focal positions, said pattern measuring method comprising:

detecting edge points of a pattern to be measured by scanning the pattern with edge reference data which is used as reference to detect the edges of the pattern within pattern images and which is configured of a plurality of pixels that are disposed so as to have an intensity

gradient, and also calculating a characteristic quantity which expresses a correlation between said edge reference data and the pattern, the edge points of which have been detected;

determining an in-focus state that expresses the degree to which the focal position at which each obtained pattern image is obtained conforms to a desired pattern edge, based on said characteristic quantity that has been calculated;

selecting the pattern image which conforms to measurement of the pattern from a plurality of the pattern images, in accordance with the result of determining said in-focus state; and

processing the selected pattern image to measure the pattern.

12. The pattern measurement method according to claim 12, wherein the imaging device includes an optical system which is capable of adjusting focal position thereof within a range defined by an integer multiple of a predetermined step width from a predetermined initial value; and

the plurality of the pattern images are pattern images that have been obtained by imaging at each of focal positions calculated by adding integral multiples of the step width to said initial value.

13. The pattern measuring method according to claim 11, wherein a plurality of pattern images are selected in accordance with the result of determining said in-focus state; and

said pattern measuring method further comprises aligning among the selected pattern images, said pattern edge points being superimposed in a single coordinate system within the pattern images, and the pattern being measured on the basis of the position coordinates of the superimposed pattern edge points.

14. The pattern measuring method according to claim 11,
wherein a plurality of pattern images are selected in accordance with the result of determining said in-focus state; and

said pattern measuring method further comprises aligning the selected pattern images and combining the pattern images, the pattern being measured based on the combined pattern images.

15. The pattern measuring method according to claim 11, further comprising:

scanning with said edge reference data only a predetermined range of edge points of the pattern which have been detected from previously processed pattern images.

16. The pattern measuring method according to claim 11,
wherein the pattern to be measured has a plurality of edge lines;

said pattern measuring method further comprises classifying said edge points that have been detected into edge point groups for each edge line;

wherein said characteristic quantity is calculated for each of said edge point groups that have been classified; and

the in-focus state of the pattern images is determined for each of said edge point groups that have been classified.

17. The pattern measuring method according to claim 11,
wherein said characteristic quantity is calculated by using a plurality of sets of said edge reference data.

18. A method of measuring a pattern based on an image of a pattern to be measured which is obtained by an imaging device which captures the pattern to be measured and includes an optical system with a focal position thereof

being adjustable with respect to the pattern by an integer multiples of a predetermined step width from an initial value, said method comprising:

detecting·edge points of a pattern to be measured by scanning an image of the pattern with edge reference data which is used as reference to detect the edge points of the pattern and which is configured of a plurality of pixels that are disposed so as to have an intensity gradient, and calculating a characteristic quantity which expresses a correlation between said edge reference data and the pattern, the edge of which has been detected;

determining an in-focus state that expresses the degree to which the focal position at which each pattern image is obtained conforms to a desired pattern edge, based on said characteristic quantity that has been calculated;

processing the image of the pattern to measure the pattern if it has been determined that the focal position at the time of capture of the pattern image conforms to said desired pattern edge; and

obtaining a new image of the pattern at different focal positions until it is determined that it conforms to said desired pattern edge by varying the focal position of the optical system if it has been determined that the focal position at the time of capture of the pattern image does not conform to said desired pattern edge.

19. A method of manufacturing a semiconductor device comprising a method of measuring a pattern to be measured from a plurality of pattern images captured and obtained at different focal positions by a pattern imaging device, said method of measuring the pattern including:

detecting edge points of a pattern to be measured by scanning the pattern with edge reference data which is used as reference to detect the edges of the pattern within pattern images and which is configured of a plurality of pixels that are disposed so as to have an intensity

gradient, and also calculating a characteristic quantity which expresses a correlation between said edge reference data and the pattern, the edge points of which have been detected;

determining an in-focus state that expresses the degree to which the focal position at which each obtained pattern image is obtained conforms to a desired pattern edge, based on said characteristic quantity that has been calculated;

selecting the pattern image which conforms to measurement of the pattern from a plurality of the pattern images, in accordance with the result of determining said in-focus state; and

processing the selected pattern image to measure the pattern.

20. A method of manufacturing a semiconductor device comprising a method of measuring a pattern based on an image of a pattern to be measured which is obtained by an imaging device which captures the pattern to be measured and includes an optical system with a focal position thereof being adjustable with respect to the pattern by an integer multiples of a predetermined step width from an initial value, said method of measuring the pattern including:

detecting edge points of a pattern to be measured by scanning an image of the pattern with edge reference data which is used as reference to detect the edge points of the pattern and which is configured of a plurality of pixels that are disposed so as to have an intensity gradient, and calculating a characteristic quantity which expresses a correlation between said edge reference data and the pattern, the edge of which has been detected;

determining an in-focus state that expresses the degree to which the focal position at which each pattern image is obtained conforms to a desired pattern edge, based on said characteristic quantity that has been calculated;

processing the image of the pattern to measure the

pattern if it has been determined that the focal position at the time of capture of the pattern image conforms to said desired pattern edge; and

obtaining a new image of the pattern at different focal positions until it is determined that it conforms to said desired pattern edge by varying the focal position of the optical system if it has been determined that the focal position at the time of capture of the pattern image does not conform to said desired pattern edge.